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Ultra-High-Energy Cosmic Rays and the Telescope Array Experiment

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The year 1912 marked the beginning of modern astroparticle physics, when Victor Hess discovered penetrating radiation of extraterrestrial origin. Since then, the energy frontier of cosmic rays has steadily expanded. In 1962, a primary cosmic ray with an energy of about 100 EeV was observed for the first time. However, more than 60 years after that observation, many fundamental questions about ultra-high-energy cosmic rays remain unresolved.

As part of the effort to address these questions, the Telescope Array (TA) experiment was established as an international collaboration in which Japanese universities and research institutes, including the Institute for Cosmic Ray Research, have played an important role. Since 2008, TA has been observing ultra-high-energy cosmic rays as the largest ultra-high-energy cosmic-ray observatory in the Northern Hemisphere. In recent years, its extension project, TA×4, has been deployed to increase the exposure at the highest energies.

In this talk, I will first review the history of ultra-high-energy cosmic-ray observations, and then present recent results from the TA experiment. Finally, I will briefly introduce proposed next-generation ultra-high-energy cosmic-ray observatories, such as GCOS.

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